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ABSTRACT

This document is a catalogue designed to help motivate students by familiarizing teachers with use and selection of manipulative materials. The first section discusses what manipulative materials are, how to use manipulative materials in instruction, in what branches of mathematics manipulative can be used, what students benefit from manipulative use, physical and pedagogical criteria for manipulative selection, and the feasibility of commercial manipulatives. Subsequent sections include the following: (1) hints for using manipulatives, (2) suggested manipulative materials, (3) suggestions for setting up a mathematics manipulative lending library that discuss lending procedures and parental involvement in using the library, and (4) three activities for the K-2 level related to addition. (Contains seven references.) (MDH)

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MANIPULATIVES: MOTIVATING MATHEMATICS

BY

KAROL YEATTS

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MANIPULATIVES: MOTIVATING MATHEMATICS

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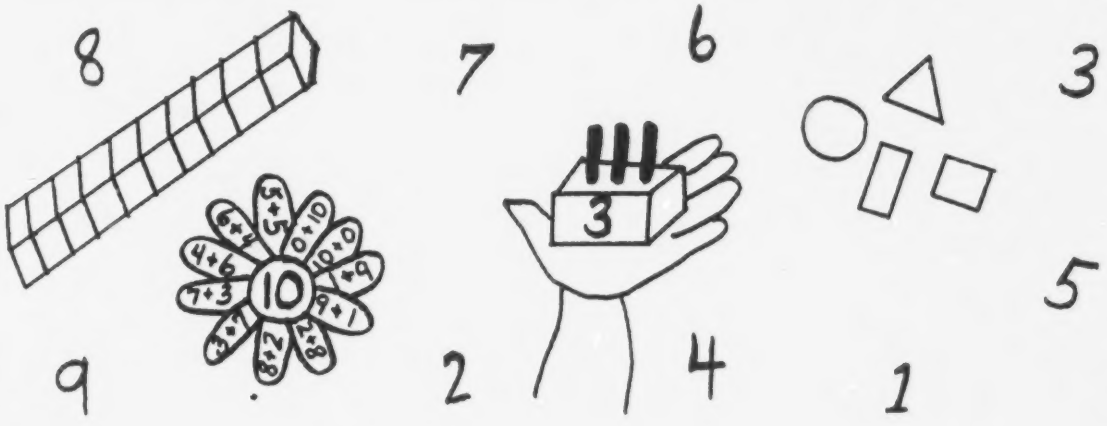

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MANIPULATIVES: MOTIVATING MATHEMATICS

TABLE OF CONTENTS

Page

Table of Contents.....1

Goals and Objectives.....2

Consider Manipulatives.....3

Helpful Hints for Using Manipulatives.....6

Suggested Manipulative Materials.....7

Setting Up A Math Manipulative Lending Library.....8

Suggestions for Checking In/Out Manipulatives.....9

Parent Survey.....10

Letter to Parents.....11

Parent Permission.....13

Using Manipulatives: Sample Instructional Activities.....15

Bibilography.....21

MANIPULATIVES: MOTIVATING MATHEMATICS

GOALS AND OBJECTIVES

GOALS:

1. To motivate, enhance, and enrich the students' interests in mathematics through the use of meaningful hands-on manipulative mathematics materials.

2. To reinforce, improve, enhance, and enrich the students' acquisition of mathematical concepts.

3. To provide an opportunity to improve and enhance parent participation.

OBJECTIVES:

1. To familiarize teachers with the current practice and use of manipulatives for instructional purposes.

2. To assist teachers in the selection and purchase of meaningful and motivating mathematical manipulative materials.

3. To assist teachers in setting up a Math Manipulative Lending Library.

4. To provide suggestions for working with parents.

CONSIDER MANIPULATIVES

What are manipulative materials?

Manipulative materials are objects or things that appeal to several of the senses. That is they are objects that students are able to feel, touch, handle, and move. The senses are stimulated as the students touch the manipulatives materials, move them about, rearrange them, and/or see them in various patterns and groupings.

The manipulation of these materials assist students in bridging the gap from their own concrete sensory environment to the more abstract levels of mathematics. Manipulatives are, therefore, effective and motivating tools for assisting and enhancing the development of mathematical concepts.

How can manipulative materials be used?

Manipulatives materials can and should be used in a variety of ways. The following is a list of some suggested ways in which manipulatives may be used:

1. To introduce a new mathematical concept.
2. To reinforce previous learning.
3. To provide concrete representations of abstract ideas.
4. To provide for individual learning styles.
5. To foster creative thinking processes.
6. To provide experiences in problem solving situations.
7. To provide opportunities for students to become active participants in their own learning experiences.
8. To provide an opportunities for students to exchange viewpoints with their classmates.
9. To diversify the educational activities.
10. To enhance interest and motivation for learning new concepts.

In what areas should manipulatives be used?

Manipulatives can be used in all branches of the mathematics program. Manipulatives materials exist that enhance numeration, sequencing, classification, spatial relationships, patterning, geometry, fractions, measurement, statistics, problem solving as well as other areas of mathematics.

Should manipulatives be used by all students?

The general consensus is that manipulative materials help provide a strong basis for conceptual learning and are recommended to be used by all students.

The use of manipulative materials for learning handicapped students can be very effective as these students often benefit from an active learning approach. Manipulative materials can be used to assist students with special learning problems to organize their thinking so that they can begin to see relationships or follow a computational procedure.

Using manipulative materials is equally valuable for those students in need of remediation. Often students in need of remediation have developed misconceptions or misunderstandings concerning various mathematical concepts. Allowing these students to use manipulatives gives them an opportunity to re-build the necessary conceptual foundations.

Manipulative materials are also valuable tools for gifted students. The use of manipulatives often allows these students to pass through the concrete stages of learning much more rapidly. Additionally, these materials can be used to extend the gifted students' thinking to higher levels, to improve their spatial visualization, to enhance their creativity, and to provide them with problem solving experiences.

What criteria should be used in selecting manipulative materials?

The selection of manipulatives falls into two categories; pedagogical criteria and physical criteria. Pedagogical criteria pertains to the educational potential of the materials and physical criteria refers to the actual physical characteristics of the manipulatives. Both aspects are important to consider in the selection process. The following lists provides suggestions to consider before using or purchasing manipulative materials.

Pedagogical Criteria

1. The materials should facilitate learning.
2. The materials should provide a clear representation of the math concept to be explored.
3. The materials should be developmentally appropriate.
4. The materials should be of high interest and motivational.
5. The materials should be adaptable, that is, they should be able to be used for more than one purpose.

Physical Criteria

1. The materials should be durable.
2. The materials should be appealing and attractive to the eye.
3. The materials should be easy to use.
4. The materials should allow for easy storage.
5. The materials should be of reasonable cost.

Should commercial manipulatives be used in place of homemade materials?

Many manipulative materials can easily be made by teachers, parents, and even students. Making manipulatives often adds to the motivational factor for using these materials. Consideration of the production cost, time and labor involved in making the materials, and the actual quality of the homemade materials should be weighed against the cost of the commercially produced materials.

HELPFUL HINTS FOR USING MANIPULATIVES

* Take into consideration the pedagogical and physical criteria when selecting meaningful and motivating manipulative materials.

* Plan and prepare in advance for the activity.

* Make a trial run, that is, try using the materials prior to the lesson in which the students will be using the materials.

* Make sure there is an adequate amount of the materials that will be used.

* Make sure that the materials are in working order, not broken or missing.

* Provide adequate time for using the materials, do not hurry or rush the activity.

* Encourage the students to think for themselves, do not provide all the answers for the students.

* Try to allow for and encourage group interaction.

* Provide follow-up question and answer time.

* Share your ideas with your peers.

SUGGESTED MANIPULATIVE MATERIALS

Abacus
Attribute blocks
Beads
Bottle tops
Calculators
Calendar
Chip trading
Clocks
Containers (qt. pt.)
Counters
Counting frame
Cuisenaire rods
Dominoes
Flash cards
Fraction sets
Geoboards
Geometric forms
Measuring cups
Measuring spoons
Money kits
Number lines
Number rods
Parquetry kits
Peg boards & pegs
Place value chart
Popsicle sticks
Puzzles
Rulers, metric
Scales
Sorting kits
Tangrams
Thermometers
Timers
Telephone
Unifix cubes
Yardstick

SETTING UP A MATH MANIPULATIVE LENDING LIBRARY

STEP 1

Carefully select and purchase the manipulative materials. Refer to the criteria to consider prior to selecting the materials found on pages 4-5.

STEP 2

Catalog and package the materials in appropriate plastic containers or bags.

Card pockets should be securely attached to each manipulative package.

Manipulative packages should be numbered on the card pocket.

Each package should have a corresponding card which is also labeled and numbered.

STEP 3

Students should be introduced to the various manipulative materials during appropriate instructional periods.

STEP 4

Letters to the parents (see pages 11-14) should be send home explaining the Math Lending Library.

Parent "help" sessions should be scheduled and held to familiarize parents with the various manipulative materials.

STEP 5

Students should be allowed to check out the materials. Refer to the suggested guide lines for checking the materials in and out found on page 9.

STEP 6

Parent Surveys (refer to page 10) should be send out to evaluate the success of the Math Lending Library.

SUGGESTIONS FOR CHECKING IN/OUT MANIPULATIVES

1. Specific days should be designated as "checking" out/in days.

2. Small groups of students should be allowed to check out the materials at one time.

3. A Bulletin Board display can be made to facilitate keeping track of the materials that are checked out. Otherwise cards can be stored in a index filing box.

4. As students check out a manipulative package they should write their name on the corresponding card found with the package's card pocket.

5. Completed "check out" cards could be collected by the teacher, an appointed student helper or a parent volunteer.

6. The cards can then be placed in the bulletin board display within the corresponding card pocket or in the index filing box.

7. As the manipulative packages are returned, the students or parent volunteer can remove the card from the bulletin board display pocket or the index filing box and place it back in the package's card pocket.

8. Manipulative packages should then be returned to their storage area.

9. Students should only be allowed to check out ONE manipulative package at a time.

10. Packages should be returned within one week's time block.

PARENT SURVEY

Dear Parents,

Your child has been participating in the Math Lending Library for the past year. At this time we would appreciate you taking a few moments to complete the following questionnaire. Thank you.

Please place a checkmark in one of the columns to indicate your response to each of the questions.

	Strongly Agree	Agree	Somewhat Agree	Disagree	Strongly Disagree
1. My child looked forward to checking out the games.					
2. My child enjoyed playing the math games at home.					
3. I enjoyed using the math games with my child.					
4. My child used the games with other family members.					
5. I have noticed an increase in my child's motivation for learning math concepts.					
6. I have noticed an improvement in my child's math skills since using the math games.					
7. I would like my child to continue using math games in future classes.					
8. The parent sessions gave useful information for working with my child.					
9. I would like to attend additional workshops giving more specific information on how to work with my child at home.					
10. Do you have any suggestions which may help to improve or add to the Math Lending Library?					

Please list your comments and/or suggestions.

LETTER TO PARENTS

Dear Parents;

Our Class is in the process of setting up a Math Lending Library. This will give the children an opportunity to check math materials and games out to use at home. The children are very excited about using these materials in school as well as being able to check these materials out for home use.

So that you may better assist your child with the use of these materials at home, we will be presenting "help" sessions for parents. Suggestions and tips will be offered during these sessions to help explain the use of these materials to you. All parents are encouraged to try to attend one of these very informative sessions.

Please complete and sign the attached form and return it as soon as possible so that we might know approximately how many parents to expect at each session.

Thank you and we look forward to seeing each of you soon.

Sincerely,

CARTA A LOS PADRES

Estimados Padres;

Nuestra Clase esta en proceso de crear una Biblioteca de Matematica. Esto le dara a los ninos la oportunidad de sacar materiales y juegos de matematica para usarlos en sus casas. Los ninos estan muy contentos por poder usar estos materiales en la escuela asi como por poder llevarselos para la casa.

Para que usted pueda ayudar a su hijo o hija con el uso de estos materiales en la casa, estamos ofreciendo unas sesiones de entrenamiento para los padres. En ellas se les daran sugerencias y explicaciones sobre el uso de estos materiales. Trate de asistir a una de estas informativas sesiones.

Por favor llene y firme la planilla adjunta y devuelvala lo antes posible para saber approximadamente cuantos padres asistiran a cada sesion.

Gracias y esperamos verlos pronto.

Atentamente,

PARENT PERMISSION

Parents, please indicate which session you will be able to attend.

Parents, please sign and return the permission slip allowing your child to participate in checking out our materials.

Thank you.

All Sessions will be held in Room _____

_____Session 1 (Specify - Day - Date - Time)

_____Session 2

_____Session 3

_____Session 4

I give permission for my child, _____,
to participate in the Math Lending Library. I will assume responsibility for materials lost or damaged by my child while he/she is participating in this program.

_____
Parent's signature

PERMISO DE LOS PADRES

Padres, por favor indique a que sesion asistira.

Firme y devuelva el permiso para que su hijo/hija pueda paricipar y llevarse los materiales para la casa.

Gracias.

Las Sesiones se ofreceran en el aula _____

____ Sesion 1 (Especifique - Dia - Fecha - Hora)

____ Sesion 2

____ Sesion 3

____ Sesion 4

Doy permiso a mi hijo/hija, _____ para participar en la Biblioteca de Matematica. Yo asumo la responsabilidad por los materiales que mi hijo/hija pierda o dane durante su participacion en este programa.

_____
Firma Del Padre

USING MANIPULATIVES: SAMPLE INSTRUCTIONAL ACTIVITIES

ACTIVITY #1

OBJECTIVE: To identify addition facts with sums equal to 10.

MATERIALS: Counters (10 per student)
Mat board

POPULATION: Primary - K-2nd grades
Small Group Instruction

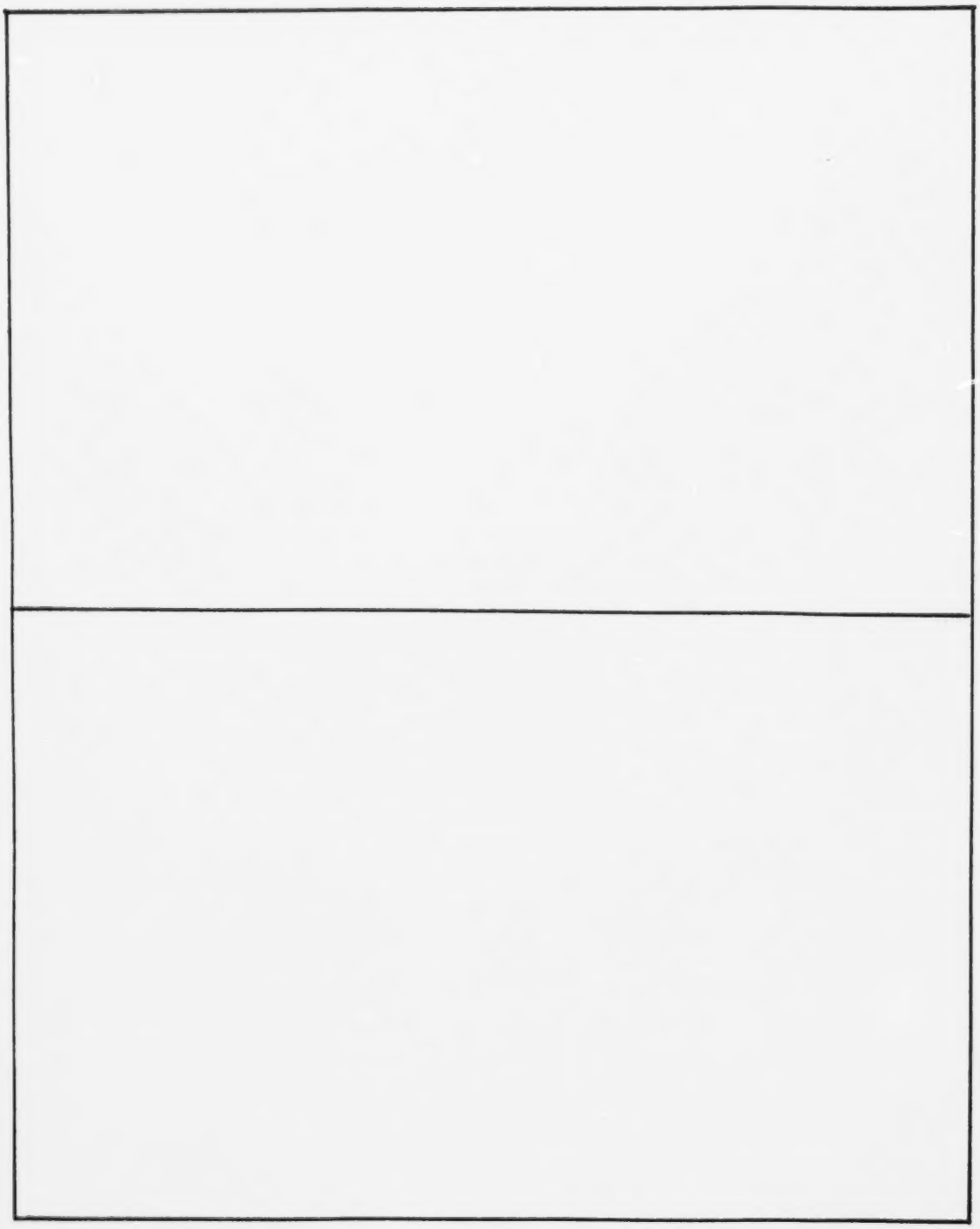
TIME: 30 minutes

PROCEDURE:

1. Introduction: Explain that today students will be identifying all the different ways to add numbers that will equal to 10.
2. Hand out the materials: Give a mat board and 10 counters to each student
3. Instruction: Have students place some of their counters on one side of the mat and the rest of the counters on the other half of the mat.
4. Discussion: Have children tell how many counters they placed on each half of their mat.
5. Record: List all the possible number combinations on the board.
6. Continue with the steps 3-5 until all possible number combinations have been identified by the students.

EVALUATION: Informal observation of students working to discover addition number combination equal to 10.

SAMPLE: ACTIVITY 1 - MAT BOARD



20

ACTIVITY #2:

OBJECTIVE: To identify addition facts with sums equal to 10.

MATERIALS: 10 counters of one color (per student)
10 counters of a second color
Worksheet
Crayons

POPULATION: Primary - K-2nd grades
Small Group Instruction and/or
Independent Work

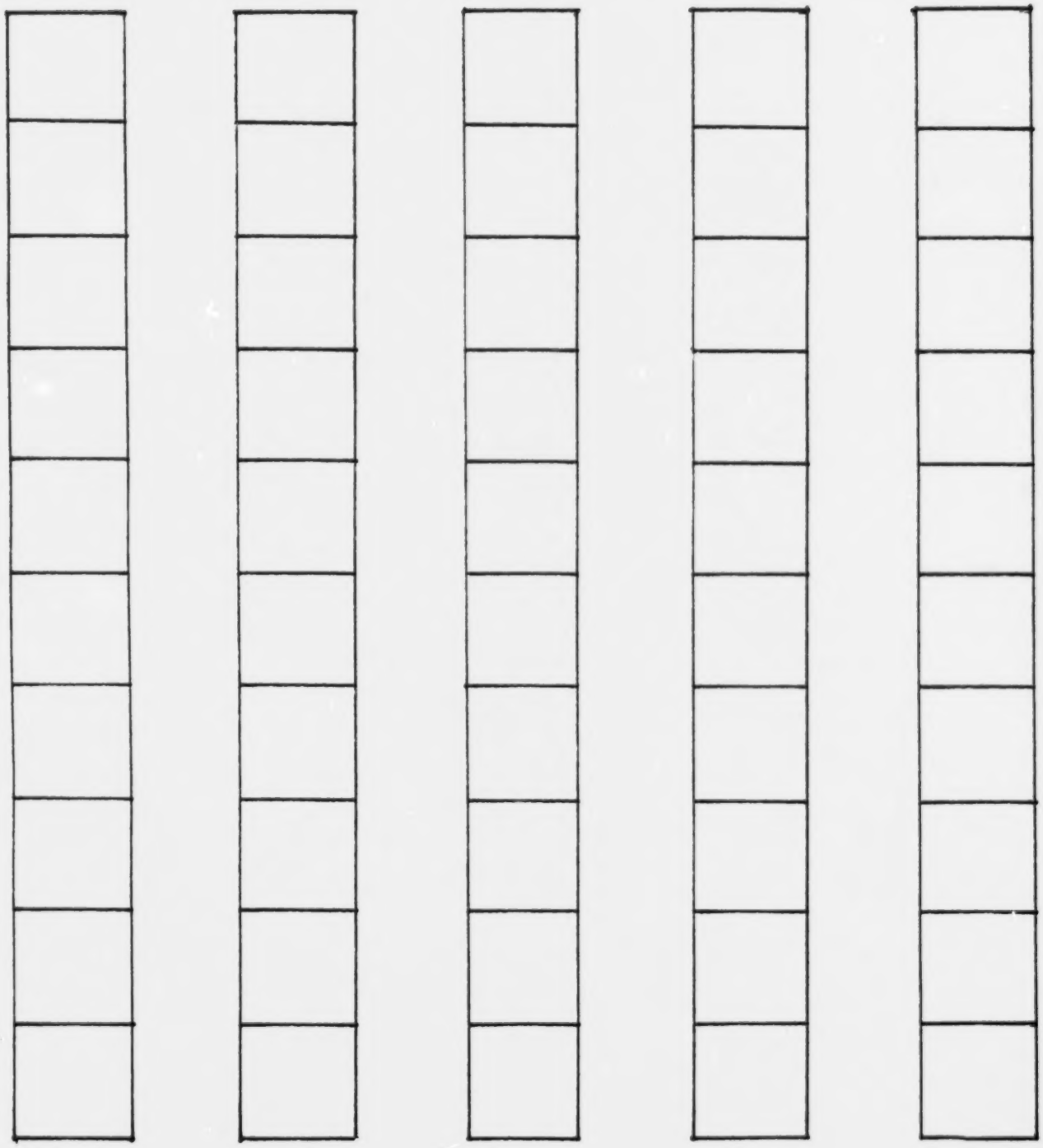
TIME: 30 minutes

PROCEDURE:

1. Introduction: Explain to the class that today they will be identifying all the different ways to add numbers that will be equal to 10.
2. Hand out the materials: Give a Worksheet and 10 counters of each color to each student.
3. Instruction: Have students place a colored counter in each of the 10 squares on the first row of their Worksheet.
4. Have students color in the squares matching the color of the square with the color of the counter.
5. Have students remove the counters and place a colored counters in each of the 10 squares on the next row.
6. Proceed following the above steps until the Worksheet is completed. Emphasize that students should try to make different combinations.

EVALUATION: Have students tell how many colored counters they placed on each row. Check worksheets.

SAMPLE: ACTIVITY 2 - WORKSHEET



ACTIVITY #3

OBJECTIVE: To identify addition facts with sums equal to 10.

MATERIALS:
Construction paper
Cardboard Petal and Center Patterns
Crayons or Markers
Scissors
Paste or Glue

POPULATION: Primary - K-2nd grades
Small or Large Group Instruction

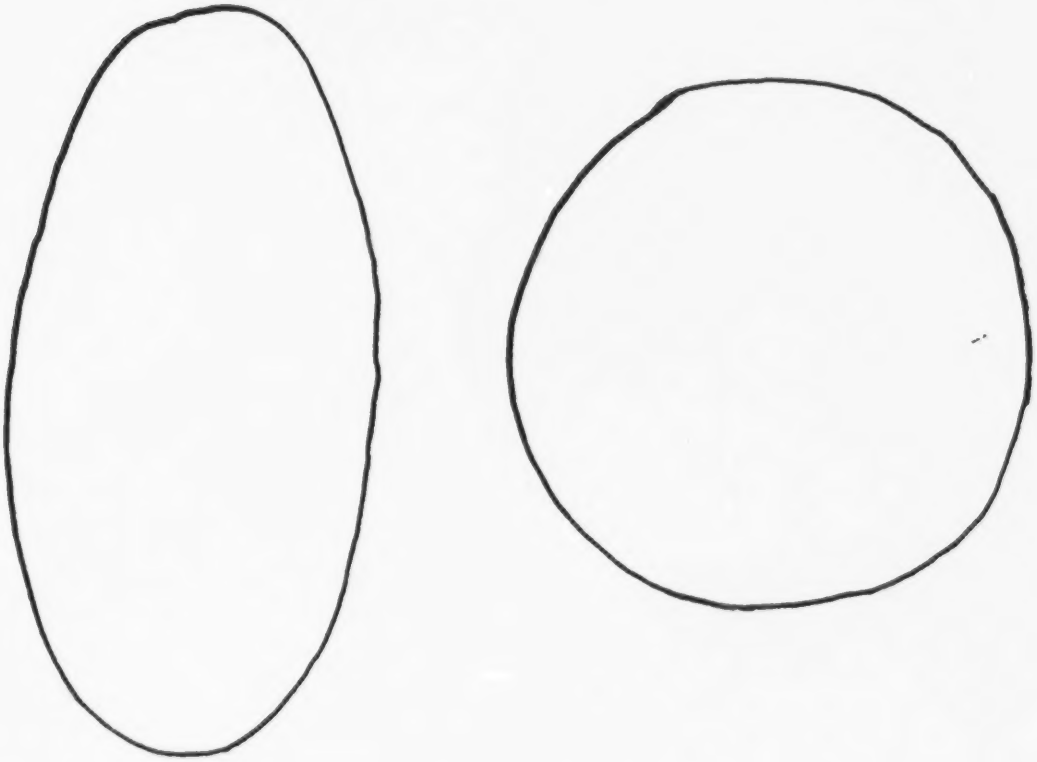
TIME: 30 to 45 minutes

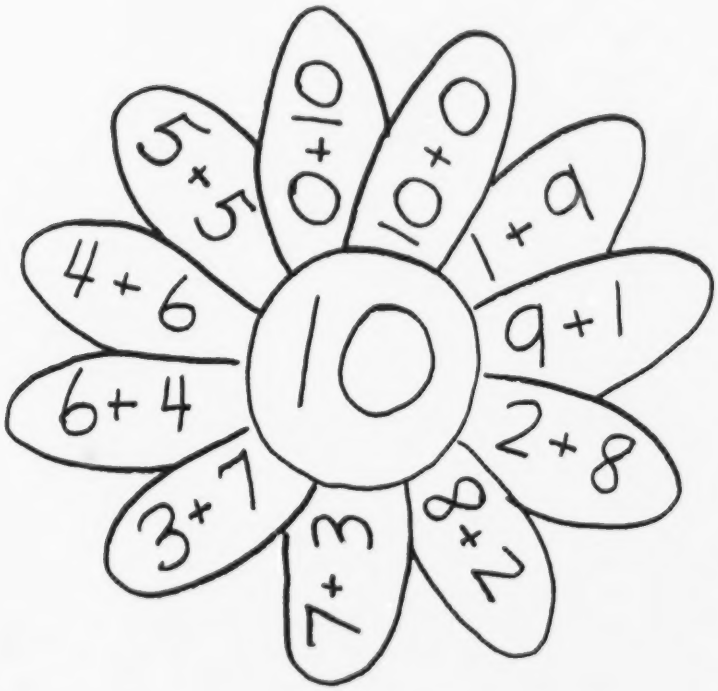
PROCEDURE:

1. Introduction: Explain to the class that today they will be making an addition fact flower for 10.
2. First have students review the addition number combinations that equal 10.
3. List these combinations on the board.
4. Hand out the materials.
5. Instruction: Have children trace around the cardboard petal and center patterns. They will need to make 11 petals and 1 center.
6. Next have the children cut the petals and center out.
7. Paste or glue the petals around the center piece.
8. Direct the children to write the number 10 on the center piece.
9. Last have the children write a different addition number combination on each of the petals.

EVALUATION: Informal observation of students.
Check students' work for accuracy.

SAMPLE: ACTIVITY 3 - FLOWER PATTERNS





24

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